

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9240	
Aircraft Registration	ZS-ZZX	Date of Accident	04 November 2013		Time of Accident	0925Z
Type of Aircraft	Air Tractor-502B (Aeroplane)		Type of Operation	Commercial		
Pilot-in-command Licence Type	Airline Transport		Age	36	Licence Valid	Yes
Pilot-in-command Flying Experience	Total Flying Hours	2 793.5		Hours on Type	785.4	
Last point of departure	Kimberly aerodrome (FAKM): Northern Cape province.					
Next point of intended landing	Kimberly aerodrome (FAKM): Northern Cape province.					
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)						
Approximately 11 kilometres West of Barkly West on the bank of Vaal river at GPS co-ordinates determined to be S28°34.07' E024°24.39' at an elevation of 3 677 feet above mean sea level (AMS).						
Meteorological Information	Temperature, 30°C: Visibility, 10 kilometres: Wind Direction, North Westerly: Wind speed, 10 knots: Cloud cover, 1/8.					
Number of people on board	1 + 0	No. of people injured	0	No. of people killed	0	
Synopsis	<p>An Air Tractor aircraft, serial number 0615 was conducting a low level line survey North West of Kimberly when the accident occurred. The pilot reported that as the aircraft was flying at 25 meters above ground level (AGL), the engine suddenly lost torque, but continued running. The aircraft couldn't climb out the other side of the valley and the pilot made a turn towards the right following the valley in an easterly direction looking for a suitable spot for a forced landing. During landing the aircraft undercarriage broke and the propeller hit the ground. The aircraft was substantially damaged and the pilot got out unharmed. Post examination of the engine at the accident site revealed a detached fuel control unit throttle linkage which caused the engine to go into idle rendering the engine to lose torque.</p>					
Probable Cause						
<p>(i) Unsuccessful forced landing due to engine power loss.</p> <p>Contributing factor/s:</p> <p>(i) Disconnected fuel control unit throttle control linkage.</p> <p>(ii) Inadequate pre-flight inspection.</p>						
IARC Date		Release Date				



AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : Xcalibur Resources (Pty) Ltd
Manufacturer : Air Tractor, INC
Model : Air Tractor 502-B
Nationality : South African
Registration Marks : ZS-ZZX
Place : West of Barkly West on the bank of Vaal River
Date : 04 November 2013
Time : 0925Z

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Purpose of the Investigation:

*In terms of Regulation 12.03.1 of the Civil Aviation Regulations (1997) this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and **not to establish legal liability.***

Disclaimer:

This report is given without prejudice to the rights of the CAA, which are reserved.

1. FACTUAL INFORMATION:

1.1 History of Flight:

1.1.1 On Monday morning 04 November 2013 the pilot who held an Airline Transport Pilot licence was conducting a low level aerial survey/airborne geophysical survey for a mining industry North West of Kimberly when the accident occurred. The pilot reported that Visual Meteorological Condition flight plan was filed and he obtained the weather forecast before departure. Take off and climb was uneventful and approximately after 4.4 hour flight time West of Barkly West as the aircraft was flying at 25 meters above ground level (AGL) on the survey line, the engine suddenly lost torque, but continued running with no cockpit warnings or vibrations.

1.1.2 The aircraft couldn't maintain height and the pilot made a turn towards the right following the valley in an easterly direction looking for a suitable spot for a forced landing since there was no fuel control unit (FCU) throttle response. The aircraft lost height and the pilot landed on the bank of Vaal river on a rocky area where after the undercarriage broke. The aircraft pitched down and the propeller struck the ground. The pilot shut down the engine and switched OFF all the electrics as per the pilot

operating handbook (POH). The aircraft was substantially damaged and the pilot got out of the aircraft unharmed. The pilot immediately via satellite phone contacted the maintenance personell or ground crew and informed them about the occurrence and they immediately deployed to the accident site. The pilot was later taken to Kimberley Medi-Cross hospital for medical examination whereafter he was later released.

1.1.3 The flight was conducted under the provisions of Part 135 of the Civil Aviation Regulations of 1997, as amended and the operator was in possession of a valid Air Operating Certificate (AOC) at the time of the accident.

1.1.4 The accident happened during day time conditions on the bank of Vaal river at GPS co-ordinates determined to be S28°34.07 ' E024°24.39 ' at an elevation of 3 677 feet above mean sea level (AMSL).

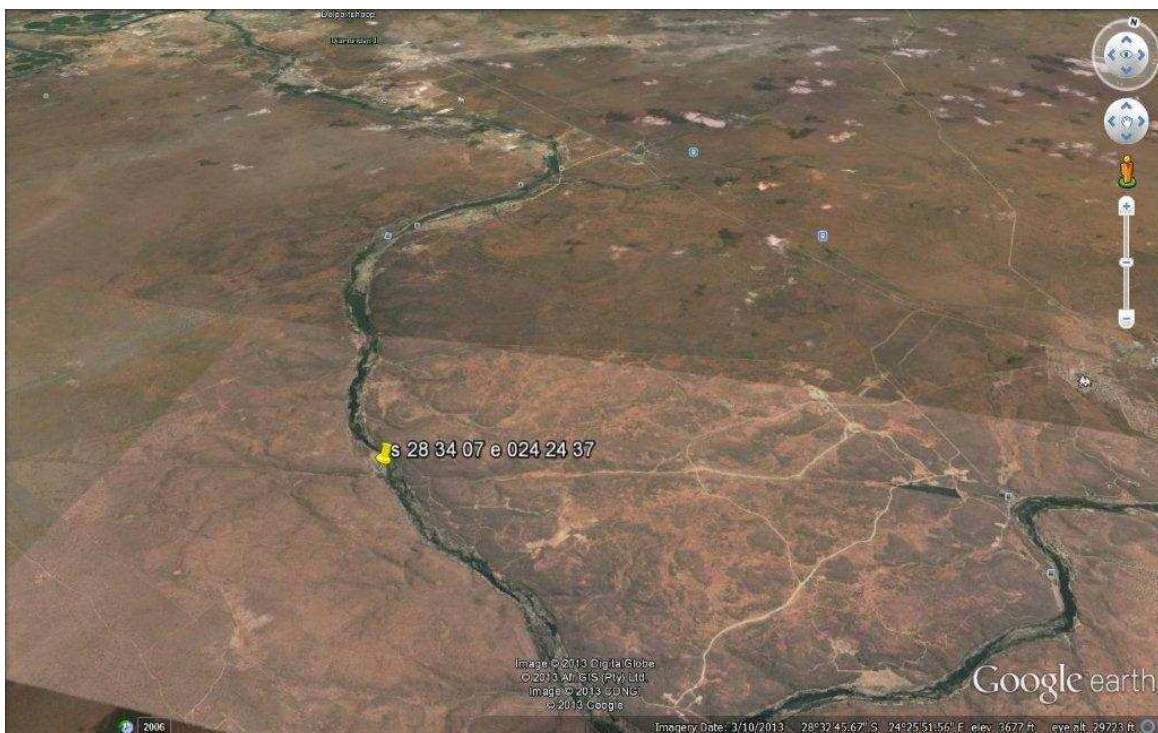


Figure 1: The accident site as per Google earth map.

1.2 Injuries to Persons:

Injuries	Pilot	Crew	Pass.	Other
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	1	-	-	-

1.3 Damage to Aircraft:

1.3.1 The aircraft was substantially damaged during the accident sequence.



Figure 2: View of the aircraft as found at the accident site on a rocky terrain.

1.4 Other Damage:

1.4.1 None.

1.5 Personnel Information:

Nationality	South African	Gender	Male	Age	36
Licence Number	0270454234	Licence Type	Airline Transport		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Night and Instrument Rating Grade A				
Medical Expiry Date	30 November 2013				
Restrictions	Nil				
Previous Accidents	Nil				

*NOTE: Investigation into SA CAA's pilot file revealed no accidents or incidents history, enforcement actions, pilot certificate or rating failure, or retest history.

Flying Experience:

Total Hours	2 793.5
Total Past 90 Days	237.8
Total on Type Past 90 Days	263.3
Total on Type	785.4

Aircraft maintenance Engineer (AME) No 1:

Nationality	South African	Gender	Male	Age	63
Licence Number	0272001124	Licence Type	AME		
Licence Expiry Date	30 March 2015	Type Endorsed	Yes		
Ratings	P & W PT6A Engine Series and Airtractor 502 Airframe Series				

*NOTE: Investigation into SA CAA's maintenance engineers file revealed no enforcement actions, rating failure, or retest history. His licence was valid and was rated on both P & W PT6A engine and Airtractor airframe.

Aircraft Maintenance Engineer (AME) No 2:

Nationality	South African	Gender	Male	Age	37
Licence Number	0272261892	Licence Type	AME		
Licence Expiry Date	17 August March 2015	Type Endorsed	Yes		
Ratings	P & W PT6A Engine Series and Airtractor 502 Airframe Series				

*NOTE: Investigation into SA CAA's maintenance engineers file revealed no enforcement actions, rating failure, or retest history. His licence was valid and was also rated on both P & W PT6A engine and Airtractor airframe.

1.6 Aircraft Information:

1.6.1 Aircraft description:

Air Tractor's 502B is a high performance single engine turboprop aircraft designed for surveillance, precision strike, and rugged dirt strip utility missions. The aircraft is equipped with a Pratt & Whitney PT6A-34AG turbine engine rated at 750 horsepower.

These engines have a three-stage axial, single stage centrifugal compressor driven by a single stage reaction turbine. Another single stage reaction turbine, counter rotating with the first, drives the output shaft. Fuel is sprayed into the annular combustion chamber by fourteen individually removable fuel nozzles mounted around the gas generator case. An ignition unit and two igniter plugs are used to start combustion. A hydro pneumatic fuel control schedules fuel flow to maintain the power set by the power control lever.

The propeller is a 3 bladed constant speed hub with a full range of operation from feather to reverse. When the Power Lever is between the idle and maximum position, the propeller revolution per minute (RPM) is controlled by the Propeller Lever. When the Power Lever is moved out of the idle detent to the reverse range then both engine power and propeller angle are controlled by the Power Lever. The propeller speed remains constant at any selected propeller control lever position through the action of a propeller governor, except in Beta range where the maximum propeller speed is controlled by the pneumatic section of the propeller governor. This aircraft must be operated in the restricted category in accordance with placards and markings inside the cockpit.



Figure 3: View of ZS-ZZX aircraft before the accident.

Airframe:

Type	Air Tractor 502B
Serial Number	0615
Manufacturer	Air Tractor, INC
Date of Manufacture	2000
Total Airframe Hours (At time of Accident)	5 715.2

Last MPI (Date & Hours)	19 October 2013	5 669.1
Hours since Last MPI	50.9	
Certificate of Airworthiness (Issue Date)	31 May 2001	
Certificate of Airworthiness (Expiry Date)	30 May 2014	
C of R (Issue Date) (Present owner)	31 May 2013	
Recommended fuel used	Jet A1	
Fuel used	Jet A1	
Operating Categories	Part 135	

*NOTE: The aircraft was maintained by an approved aircraft maintenance organisation (AMO) number 282 that was in possession of a valid AMO Approval certificate that had been issued by the regulating authority (SA Civil Aviation Authority).

Engine:

Type	Pratt and Whitney PT6A-34AG
Serial Number	PCE-PH0358
Hours since New	2 606.8
Hours since Overhaul	TBO not yet reached

Propeller:

Type	Hartzell HC-B3TN-3D/T
Serial Number	BUA30001
Hours since New	22.38.0
Hours since Overhaul	46.8

*NOTE: According to the aircraft file, the aircraft was imported to South Africa from United States of America (USA). The aircraft was then registered on the South African Civil Aircraft Register which was approved for special operations such as aerial patrol, observation and aerial survey in accordance with applicable regulations.

The aircraft documentation such as the certificate of registration, the certificate of airworthiness and certificate of release to service were reviewed during the investigation. An examination of the aircraft's maintenance documentation showed that all relevant inspections had been carried out, and complied with relevant service bulletins.

The aircraft flight folio was found to be in compliance with applicable regulations in accordance with CAR; Part 43. The evidence found showed that the identified aircraft documentation was valid in compliance with applicable regulation.

Maintenance: The last maintenance carried out of the aircraft was a mandatory periodic inspection (MPI) that was signed out on the 19th of October 2013 at 5 669.1 airframe hours. The interval of the MPI was within 12 calendar months or 150 hours or whichever comes first. After the MPI was completed, the aircraft maintenance organization responsible for the maintenance certified the aircraft airworthy and a certificate of release to service was issued. The aircraft was then flown on aerial survey flights around Kimberly situated in the Northern Cape without any incidents.

On the 19th of October 2013 a Pratt and Whitney PT6A-34AG engine was removed from ZS-LHD aircraft and fitted on ZS-ZZX aircraft because ZS-ZZX aircraft engine was timex and had to be overhauled. Dual inspection was performed by certifying licensed aircraft maintenance and all was found to be satisfactory. Ground run was carried out and the engine was found to be operating normally. The aircraft was again released to service.

1.7 Meteorological Information:

1.7.1 Weather information was obtained from the pilot questionnaire.

Wind direction	North Westerly	Wind speed	10 knots	Visibility	10 km
Temperature	30°C	Cloud cover	1/8	Cloud base	None
Dew point	None				

1.8 Aids to Navigation:

1.8.1 The aircraft was equipped with standard navigation equipment. All the navigation equipment's were serviceable prior to the accident.

1.9 Communications:

1.9.1 The communication equipment that was installed in the aircraft was found to be in accordance with the approved equipment list.

1.10 Aerodrome Information:

1.10.1 The accident happened during day time conditions on the bank of Vaal river at GPS co-ordinates determined to be S28°34.07 ' E024°24.39 ' at an elevation of 3 677 feet above mean sea level (AMSL).

1.11 Flight Recorders:

1.11.1 The aircraft was not fitted with a Flight Data Recorder (FDR) or a Cockpit Voice Recorder (CVR), nor was it required by regulation.

1.12 Wreckage and Impact Information:

1.12.1 The accident happened during forced landing on the bank of Vaal River West of Barkly West after the pilot experienced an engine power loss in flight. The undercarriage broke and the propeller hit the ground. Damage was limited to the undercarriage, the wings, the fuselage, the propeller, the engine and the surveillance equipment fitted on the aircraft. The cockpit/cabin area was intact and flight control continuity on some of the flight control surfaces was established.

1.12.2 The wreckage distribution revealed that the aircraft had impacted the ground at a relatively low speed. The aircraft's wing flaps were estimated to be at an angle of about 10 degrees, which was consistent with the landing approach configuration. Three propeller blades bent backward and the propeller spinner remained attached and intact.



Figure 4: View of the aircraft on the bank of Vaal River.



Figure 5: Position of the right gear and debris as found at the accident site.

1.13 Medical and Pathological Information

1.13.1 The pilot sustained no injuries.

1.14 Fire:

1.14.1 There was no evidence of a pre or post impact fire.

1.15 Survival Aspects:

1.15.1 The accident was regarded to be survivable. The cockpit/cabin area remained intact and the pilot was wearing the aircraft equipped safety harnesses.

1.16 Tests and Research:

1.16.1 Post accident examination of the airframe revealed no anomalies with the aircraft flight controls. There was sufficient Jet A1 fuel on the aircraft, free from contamination and the fuel selector was found on a closed position, most probably by the pilot after the accident. Inspection on the engine revealed that the self locking castellated nut and the split pin that fasten or secure the bolt that holds the fuel control unit throttle linkage was missing and the bolt disconnected and fell to the bottom of engine onto the nacelle. Throttle “a means for the pilot to control and monitor the operation of the aircraft's powerplant or engine” response was lost and the engine instantaneously went into idle and the aircraft couldn't maintain flying speed. Below are pictures of an air tractor aircraft throttle, a detached fuel control unit linkage and the bolt that was found onto the bottom on the engine nacelle.

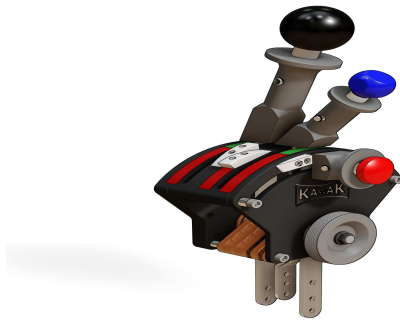


Figure 6: View of an aircraft throttle.

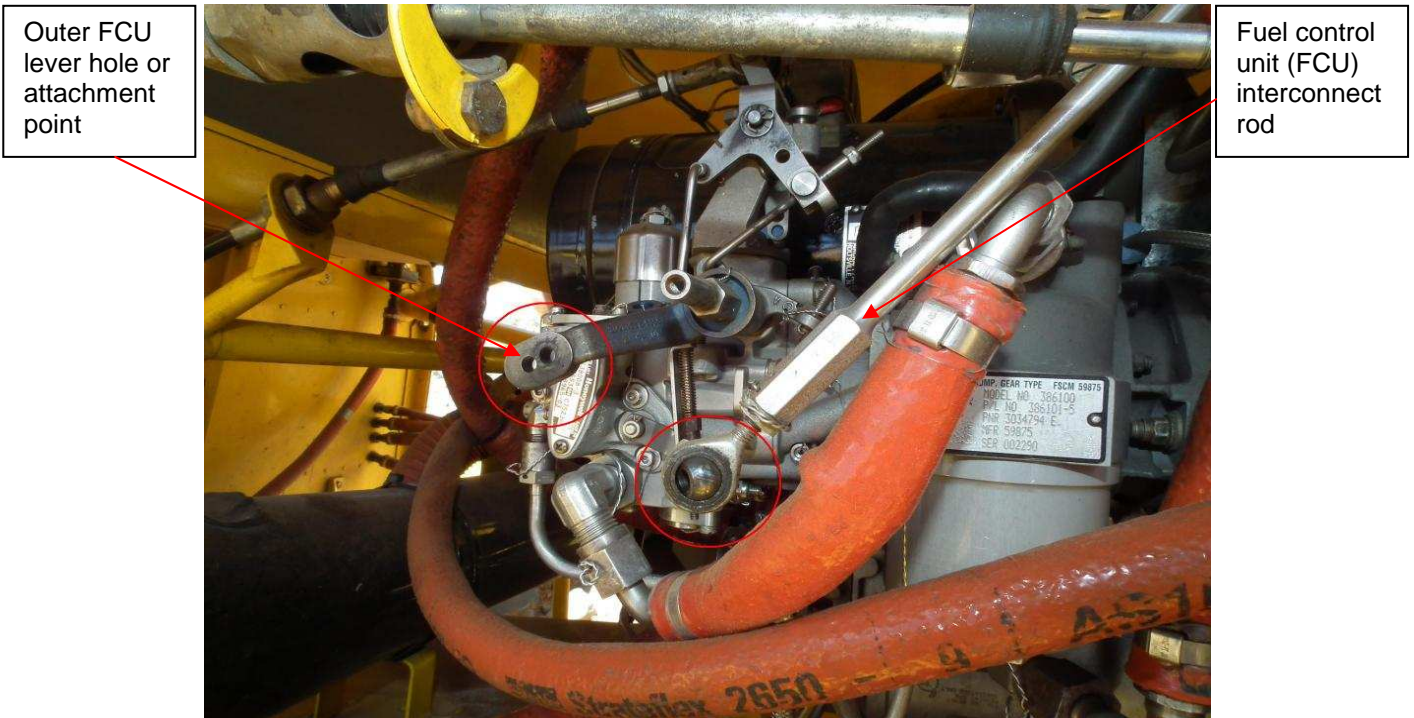


Figure 7: View of a detached fuel control unit linkage.



Figure 8: View of the bolt that was found inside the engine cowling.

- 1.16.2 Examination of the engine and airframe logbooks showed a Pratt and Whitney engine, serial number PCE-PH0358 installed on ZS-ZZX aircraft followed by a mandatory periodic inspection (MPI) on the 19th of October 2013. The two certified aircraft maintenance engineers identified on the report performed the tasks whereafter number 2 engineer independently counter signed the duplicate/dual inspection in accordance with the requirements of CATS 43.02.6(2), general maintenance rules. The aircraft was thereafter subjected to a ground run, test flown by a certified test pilot with an appropriate rating and released to service. During the process, the AMO was requested to submit the aircraft maintenance manual to the investigation team. The team reviewed the manual which should contain an in depth step by step guide of how to perform the task and there was no reference to it.
- 1.16.3 However, a PT6 power plant rigging instruction manual dated 11th October 2003, page 1 to 22 clearly shows a combination of fasteners approved to secure the FCU control linkage to the power plant and further more illustrates or demonstrates how the FCU control linkage should be secured and rigged before service. It is again well known to aircraft technicians and engineers that a combination of this category of fasteners “castellated nut and a bolt with a transverse hole” should be secured by means of a split pin or cotter pin with the intention to hold the nut against rotation. Further testing or analysis of the engine and its components by the investigating team was considered not necessary and the wreckage was released to the owner. Below is an illustration of how a castellated nut should be secured by a split pin.



Figure 9: Locking of a castellated nut on bolt .

1.17 Organizational and Management Information:

1.17.1 This was a commercial flight.

1.17.2 The Inspection that was carried out on the aircraft prior to the accident was certified on 19th of October 2013 by Aircraft Maintenance Organization (AMO) No 282 at 5 669.1 airframe hours.

1.17.3 This operator is a South Africa based airborne geophysical company that specializes in ultra high resolution and standard airborne surveys. The company collect data at lower ground clearance (typically 10 metres to 40 metres above ground level). Because spatial resolution and signal to noise ratios improve dramatically when flight altitude is reduced, low level data provides significantly more detailed information for kimberlite (mineral) detection, base and precious metal exploration, structural mapping and mine planning. The survey height is generally only limited by the height of the vegetation and the presence of man made features such as power lines, buildings and antennas.

1.18 Additional Information:

1.18.1 None.

1.19 Useful or Effective Investigation Techniques:

1.19.1 None.

2. ANALYSIS:

2.1.1 The pilot was properly certificated and qualified under the Civil Aviation Regulations to perform the flight. No evidence indicated any medical or behavioral conditions that might have adversely affected his performance during the accident flight. The pilot has logged a total of 2 793 total flight time and has a total of 785.4 flight hours on aircraft type. The Weather information obtained from the pilot's questionnaire indicated that fine weather conditions prevailed at the time of the flight and subsequent accident. The investigation revealed the cause of the accident as the inappropriate maintenance {(maintenance induced failure) (MIF)} by maintenance personnel who omitted to insert a split pin through the bolt hole after maintenance.

2.1.2 In addition, the certifying licensed aircraft maintenance engineer who performed a duplicate inspection and counter signed the task should not have signed the release to service "meaning that the aircraft is inspected accordingly and was found to be in airworthy condition" without ensuring that physical check or inspection had been carried out. This portion of the inspection is a look, touch and feel event and in addition, experience with the particular type of aircraft is also very beneficial as each aircraft has it's own areas of continuing problems. Inspections are not simply just for looking for problems, but rather for looking for potential or possible weaknesses in order to prevent problems before they happen.

- 2.1.3 In this regard a commonly used means for preventing nuts coming loose from bolts in service is the use of split pins. Typically, a split pin is inserted between the castellations or slots of a castellated nut, and through a hole in the bolt, until the head of the pin fits between two castellations. The split ends of the pin are then bent 90° (degrees) over by means of a plier or wire cutter, thus retaining the pin in the hole and locking the nut onto the bolt. A potential disadvantage to this method of using split pins is that, when the nut is tightened on the bolt, the gaps between the castellations may not line up with the pre drilled hole in the bolt. If necessary, and by means of an additional tightening of the nut within the torque limit, a technician should align the hole of the screw or bolt with the groove of the nut.
- 2.1.4 Further more the nut shall under no circumstances be tightened over the values exceeding the upper margin “maximum” of the specified torque, in order to facilitate the assembly of the split pin. Finally the length of the lower point of the split pin, shall be such, that it shall not stick out from the base of the nut, so as to avoid scratches and prevent corrosion produced by its contact with whichever metal, on which the screw or bolt is assembled. In conclusion, maintenance related accidents and incidents are caused by a breakdown of the organization processes, decisions and culture. Maintenance operations are also affected by human input that shows up as weaknesses in organizational processes leading to lack of motivation, fatigue and stress, time pressure, misperception of hazards and inadequate skills.

3. CONCLUSION:

3.1 Findings:

- 3.1.1 The pilot held an Airline Transport pilot license, and was endorsed to fly the aircraft type.
- 3.1.2 The pilot was medically fit at the time of the occurrence.
- 3.1.3 The aircraft had a valid Airworthiness certificate at the time of the accident.
- 3.1.4 The aircraft was approved for special operations such as aerial patrol, observation and aerial survey in accordance with applicable regulations.
- 3.1.5 The aircraft was conducting a low level aerial survey/airborne geophysical survey for a mining industry North West of Kimberly when the accident occurred.
- 3.1.6 The AMO that performed the last inspection on the aircraft prior to the accident flight was in a possession of a valid AMO Approval certificate No 282.

3.1.7 Available information indicated that fine weather conditions prevailed in the area at the the time of the flight and subsequent accident.

3.1.8 The accident occurred in daylight conditions.

3.1.9 The accident was considered survivable.

3.1.10 Inappropriate maintenance.

3.1.11 Improper pre-flight inspection.

3.2 Probable cause:

3.2.1 Unsuccessful forced landing due to engine power loss.

3.3 Contriburinf factor/s:

3.3.1 Disconnected fuel control unit throttle control linkage.

3.3.2 Inadequate pre-flight inspection.

4. SAFETY RECOMMENDATIONS:

4.1 None.

5. APPENDICES:

5.1 Duplicate inspection:

In accordance with the requirements of CATS 43.02.6(2) a duplicate inspection of all control systems must be carried out after the initial assembly and at any time the system have been disturbed in any way. A duplicate inspection in therefore carried out in the following way:

- ❖ The certifying AME responsible for the work inspects the control system in accordance with the manufacturers requirements and, if satisfactory, certifies the work as acceptable.

- ❖ Subsequently, a second AME or commercial pilot independently inspects the control system in accordance with the manufacturers requirements and, if satisfactory, certifies the work as acceptable.

- ❖ A duplicate inspection is certified independently by each person in the appropriate logbook using certification statement.

5.2 Maintenance personnel checklist:

This checklist was developed by mechanics as an error prevention strategy to be utilized by mechanics in the management of human error in maintenance. This will not only help reduce errors, but will help capture and contain errors:

(i) Before the task:

- Do I have the knowledge to perform the task?
- Do I have the technical data to perform the task?
- Have I performed the task previously?
- Do I have the proper tools and equipment to perform the task?
- Have I had the proper training to support the task?
- Am I mentally prepared to perform the task?
- Am I physically prepared to perform the task?
- Have I taken the proper safety precautions to perform the task?
- Do I have the resources available to perform the task?
- Have I researched the Regulations to ensure compliance?

(ii) After the task:

- Did I perform the task to the best of my abilities?
- Was the task performed to be equal to the original?
- Was the task performed in accordance with appropriate data?
- Did I use all the methods, techniques and practices acceptable to the

industry?

- Did I perform the task without pressures, stress and distractions?
- Did I re inspect my work or have someone inspect my work before return to service?
- Did I make the proper record entries for the work performed?
- Did I perform the operational checks after the work was completed?
- Am I willing to sign on the bottom line for the work performed?
- Am I willing to fly in the aircraft once it is approved for the return to service?

5.3 Air Tractor engine controls: Air Tractor Manual AT502A/502B.

A quadrant on the left hand side of the cockpit incorporates the Power lever, the propeller control lever and the Start control lever. The Power lever has an idle stop and cannot be moved into the reverse range without moving the trigger at the top of the lever forward. Do not allow the power lever to be moved into the reverse range unless the engine is running or else the control linkage could be damaged. The Start lever has a latch that prevents inadvertent movement below the "Run" position that would shut off the fuel in flight.

The Star lever should always be in the "Flight idle" idle position during flight to allow the engine to remain spooled up enough during approach to allow quick acceleration in case a go around is required. it is important to remember that only with the Start lever full back at the most aft stop position is the fuel cut off. The Propeller lever may be placed in full forward position during the start sequence for more convenient movement for the start lever provided the temperatures are warm. For cold weather starts the Prop lever should be aft, as called out in the starting instructions, as initial oil pressure will go to engine bearings instead of the propeller dome. All engine controls utilize push pull cable assemblies.

5.4 Power plant rigging instructions:

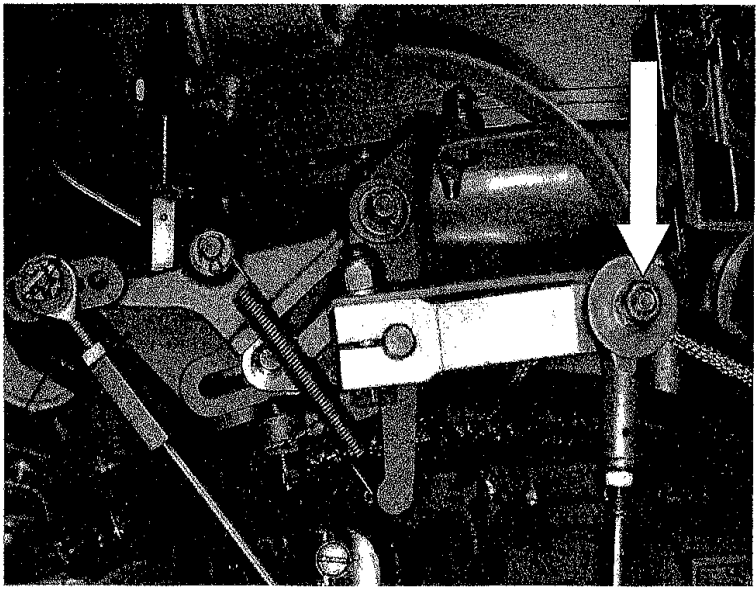
1 OK TO USE PARTS MADE		4 NOW SHOP PRACTICE	
2 PARTS MAY BE REWORKED		5 SCRAP EXISTING PARTS	
3 RECORD CHANGE		NOTED	
LETTER	EFFECTIVITY	CHANGE	BY
A	0680	ADDED IMPROVED INSTRUCTIONS	11/10/03 MS LS
REF		DATE	CHK
3		11/10/03	MS LS

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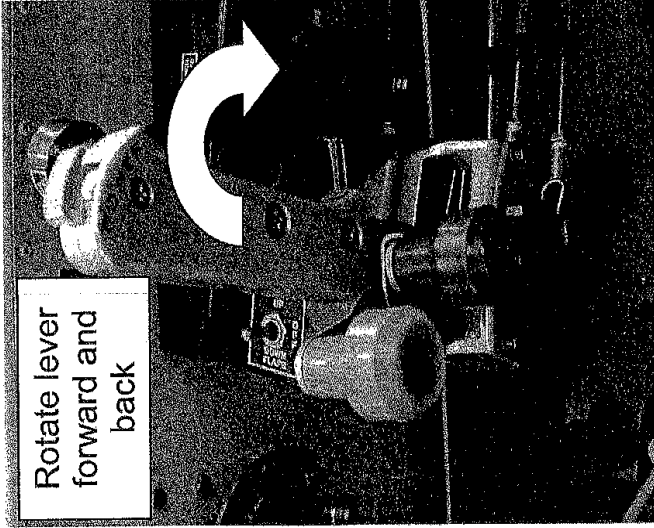
NOTE: 1. RIG ENGINE PER RIGGING INSTRUCTIONS ON PAGES 1 - 22.

ITEM	PART NUMBER	NO. ROD.	DESCRIPTION	SIZE	SPEC.	ZONE	NO. ROD.	SCALE	REV
	70479-1	1	INSTRUCTIONS				1	70216	402
							1	70450	502

REMOVE ALL BURRS AND SHARP CORNERS	DRAWN	LS	DATE	3/24/89	CHECKED	
WELD	APPROVED		EFFECTIVITY			
FINISH	INSTALL RIVETS PER PS129 EXCEPT AS NOTED					
HEAT TREAT	INSTALL BOLTS PER PS130 EXCEPT AS NOTED					
ACT. WT.	CALC. WT.	ANGLES ± 1/16 FRACTIONS ± .005 .040 TO .1285 DIA. ± .002 - .001 .136 TO .228 DIA. ± .003 - .001 .234 TO .560 DIA. ± .004 - .001 .515 TO .750 DIA. ± .005 - .001				
SNOW ENGINEERING CO. WICHITA FALLS, TEXAS						DRAWING NUMBER
RIGGING INSTRUCTIONS						70479
						PAGE 0 OF 22

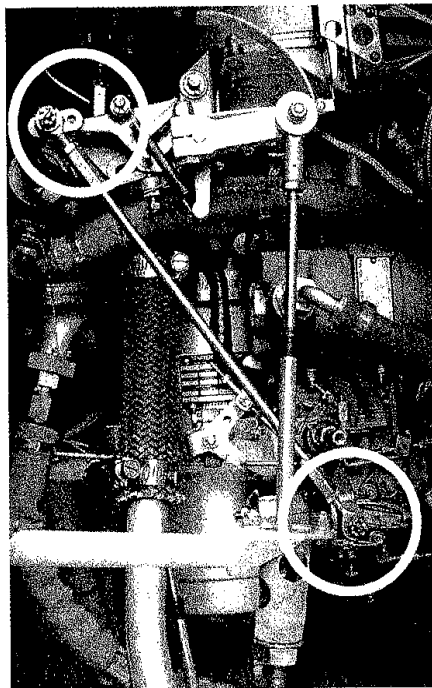
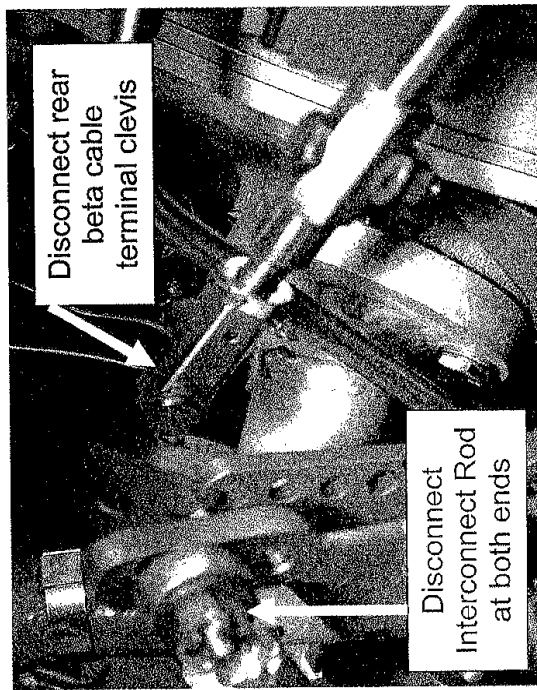
<p>Powerplant Rigging Procedure Small PT6</p>	<p>11/10/03</p>	<p>70479 Page 1 of 22</p>
	<p>Operation 1100 Power Control Cable Check</p> <p>(a) Disconnect the telescopic unit terminal end from the cambox power control input lever.</p>	

Powerplant Rigging Procedure Small PT6	11/10/03	70479 Page 2 of 22
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	<p>Operation 1100 Power Control Cable Check</p> <p>(b) Move the cockpit power lever through the full range and verify that the motion is free of binding and excessive friction.</p>
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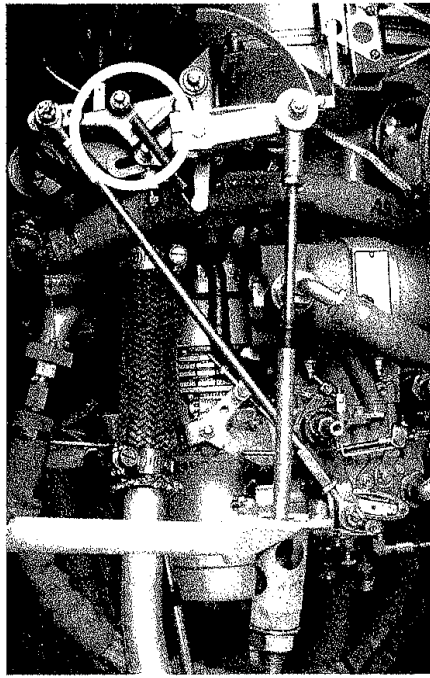
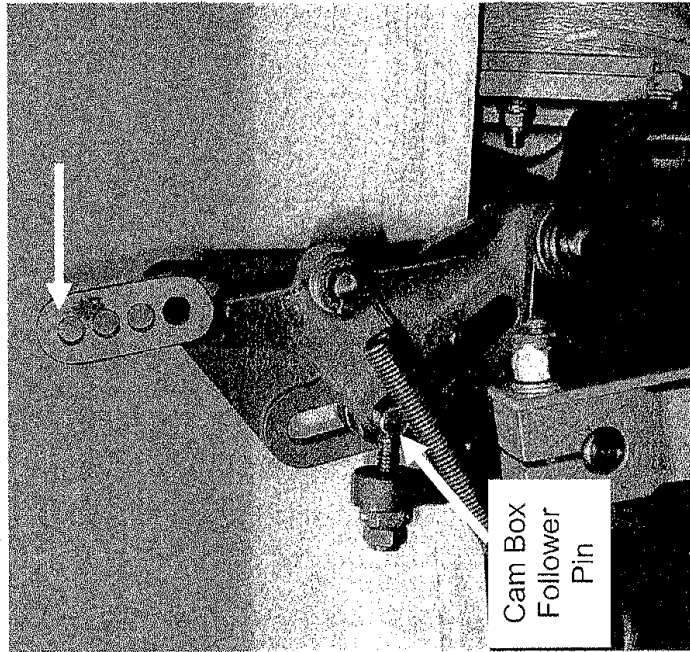
**Operation 1200
Aircraft Power Control Cable Motion Centering Check**

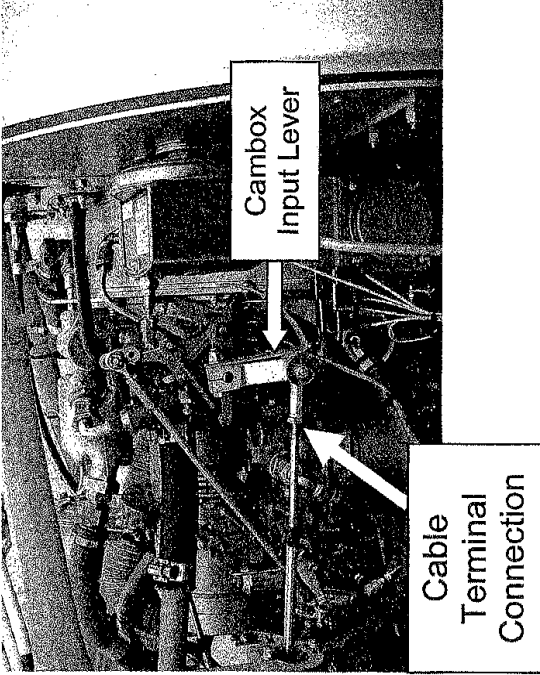
- (a) Disconnect rear beta cable terminal clevis from beta cam by removing cotter pin and linkage pin and washer.
- (b) Disconnect both ends of the FCU interconnect rod.

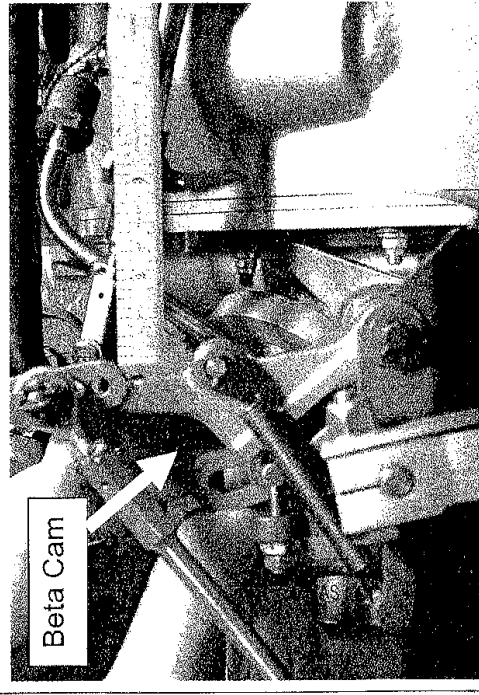
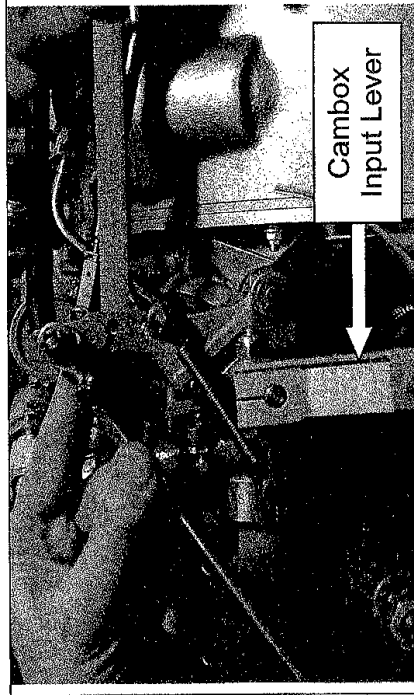


**Operation 1200
Aircraft Power Control Cable Motion Centering Check**

(c) Position the cambox input lever in the idle position - Where the cambox follower pin is at beta track point and the four holes at the top of the cam just start to move rearward.



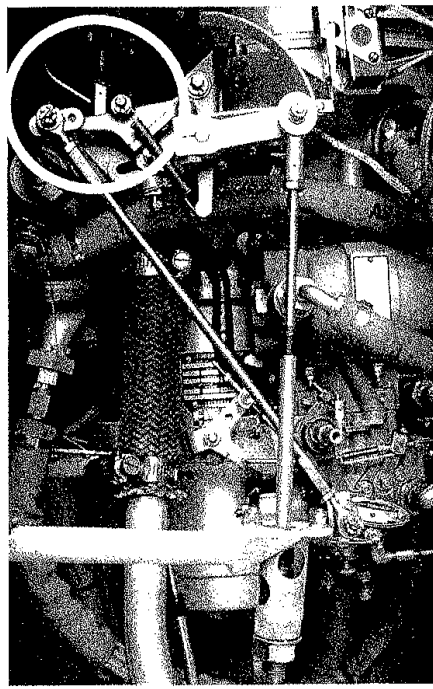
<p>Operation 1200 Aircraft Power Control Cable Motion Centering Check</p>	<p>(d) Move the cockpit power lever through its full range of motion and verify that the cable terminal has sufficient travel to move the cambox input lever through its full range. Adjust the cable terminal connection on its support bracket if required.</p>
	



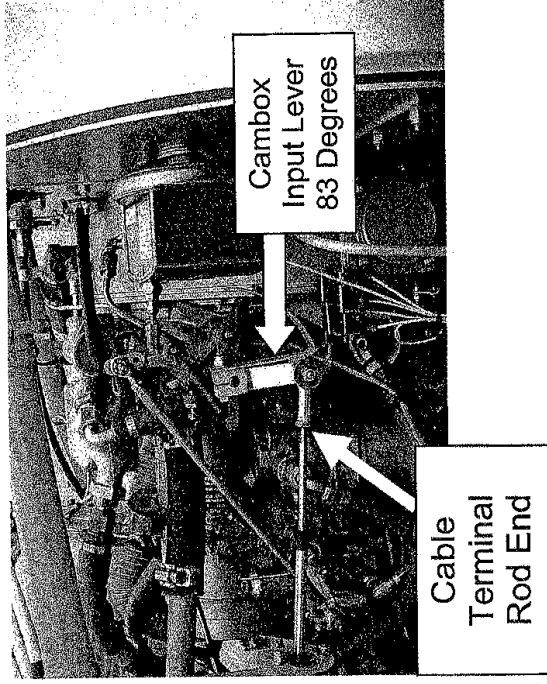
Operation 1300

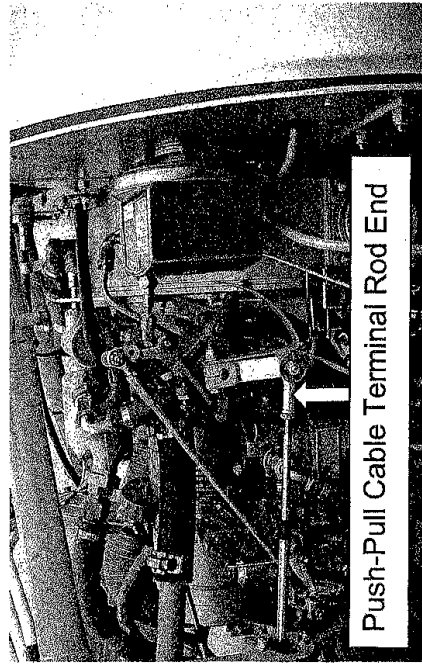
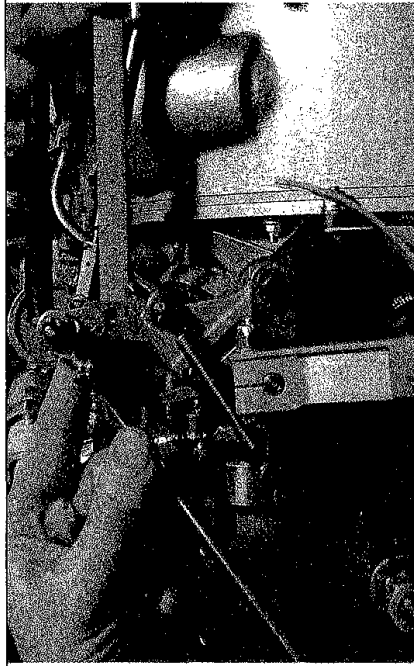
Connect Aircraft Power Control Cable to Cambox Input Lever

- (a) Move the cockpit power control lever into the forward range and back to the IDLE detent.
- (b) With light forward pressure on the top of the beta cam move the cambox input lever counter-clockwise from the track point position to the position where the second-lowest beta cam hole has moved aft by 0.150 inch. (.5/32 inches)



<p>Powerplant Rigging Procedure Small PT6</p>	<p>11/10/03</p>	<p>70479 Page 7 of 22</p>
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	<p>Operation 1300 Connect Aircraft Power Control Cable to Cambox Input Lever</p> <p>(c) Verify that the cambox input lever is installed at 83 degrees slightly from vertical</p> <p>(d) Adjust the length of push-pull cable terminal rod end to align with the hole in the cambox input lever and connect.</p>
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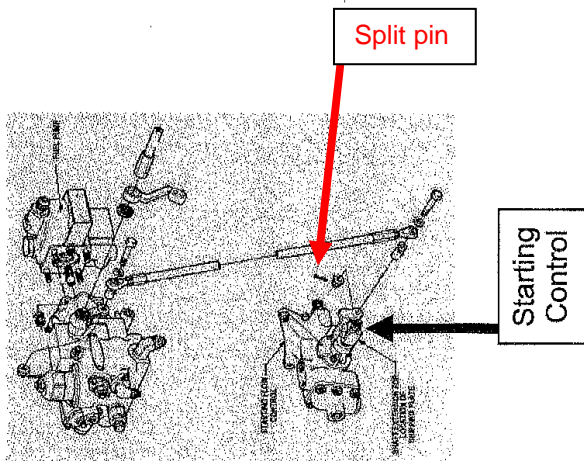


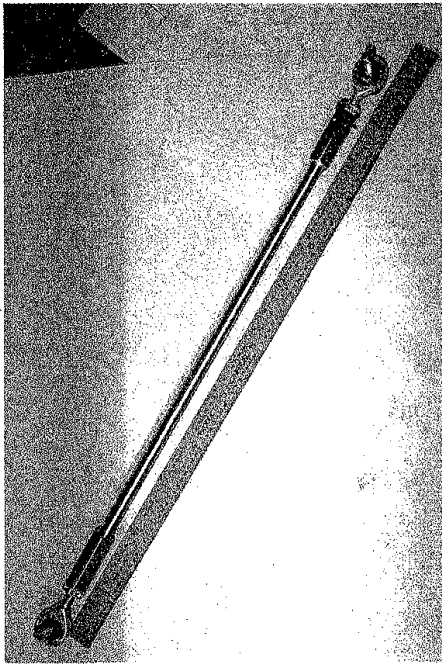
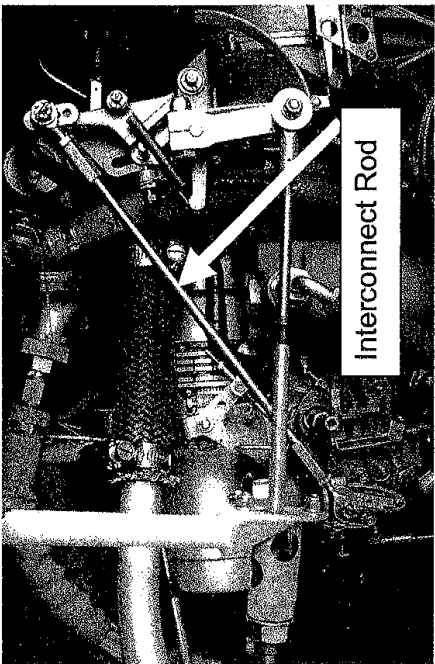
Operation 1300

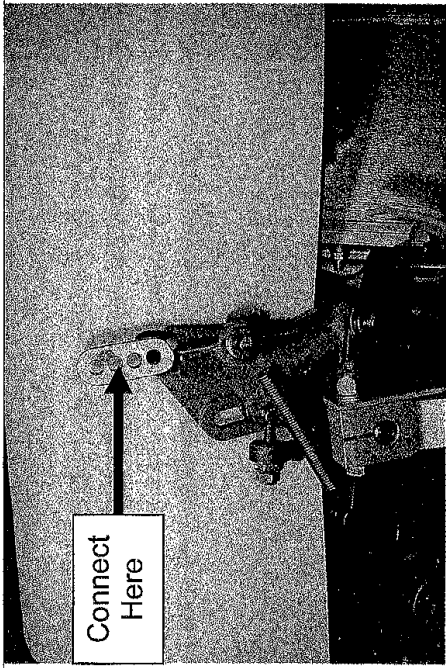
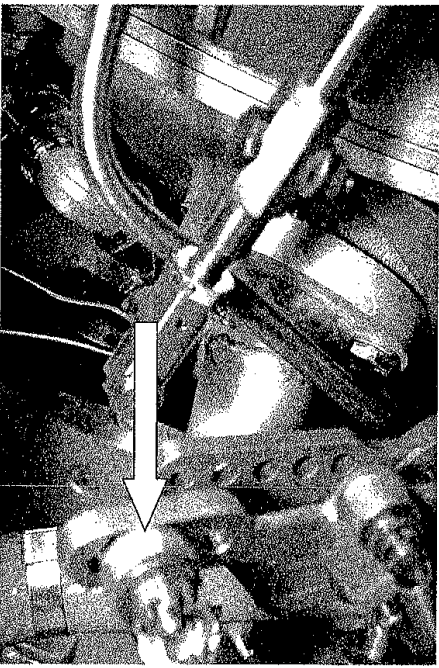
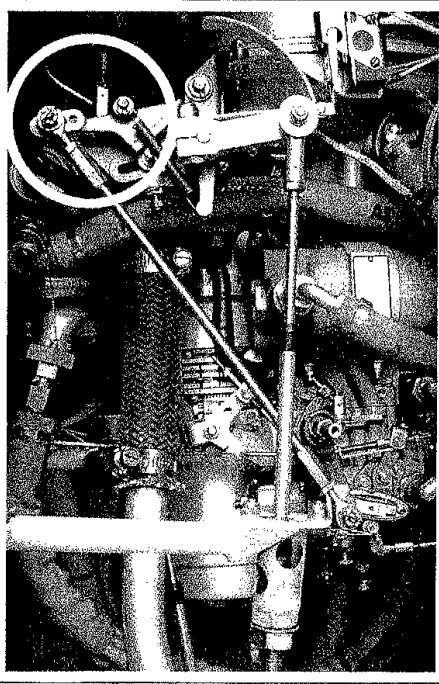
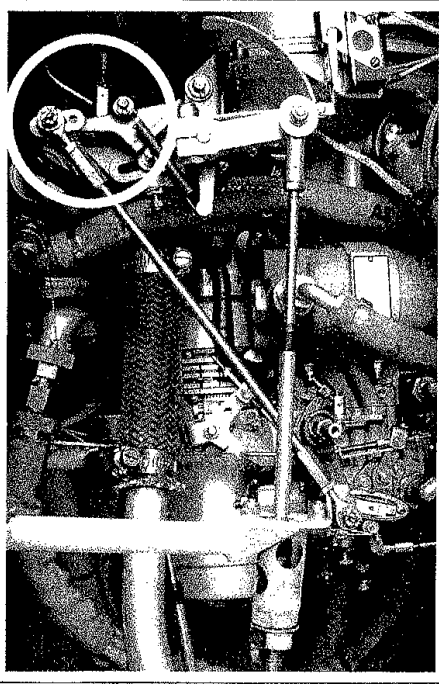
Connect Aircraft Power Control Cable to Cambox Input Lever

- (e) With light forward pressure on the top of the beta cam, move the cockpit power lever into the forward range and return it slowly to the idle detent. Confirm that the second-lowest cam hole moves aft by 0.150 inch (5/32 inches) as the cockpit lever contacts the IDLE detent.
- (f) Adjust the length of push-pull cable terminal rod end to align with the hole in the cambox input lever and connect.

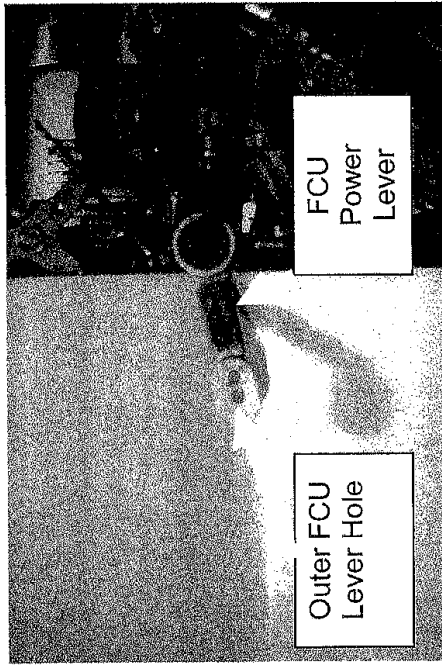
- (g) Move the cockpit power lever through the full range and verify that the linkage operates smoothly without jamming or binding.
- (h) Tighten all power control cable terminal fasteners.

	<p>Operation 1400 Rig FCU Linkage to start control Ref. Operation 2000 (If Applicable)</p>
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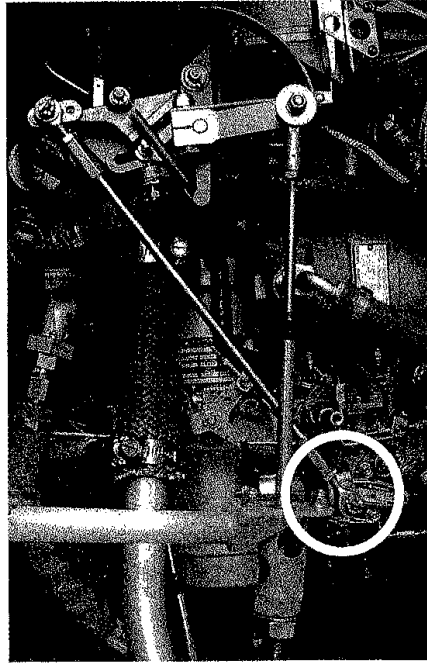
<p>Powerplant Rigging Procedure Small PT6</p>	<p>11/10/03</p>	<p>70479 Page 10 of 22</p>
	<p>Operation 1400 Rig FCU Linkage</p> <p>(a) Set the FCU interconnect rod length to 11.125 in. (11 1/8 in)</p> 	

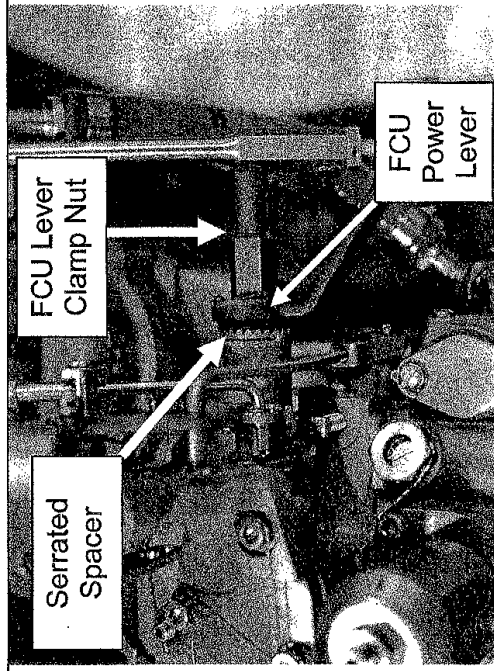
<p>Powerplant Rigging Procedure Small PT6</p>	<p>11/10/03</p>	<p>70479 Page 11 of 22</p>
	<p>Operation 1400 Rig FCU Linkage</p> <p>(b) Connect one end of interconnect rod to hole 3 (second from top) of the cambox intermediate lever.</p>	
		

**Operation 1400
Rig FCU Linkage**



- (c) Move the cockpit power lever into the forward range and back to the IDLE detent. Tighten friction lock.
- (d) Lift the FCU power lever to the position where pick-up on the internal governing mechanism is felt and align the rear interconnect link rod end with the outer FCU lever hole and connect.



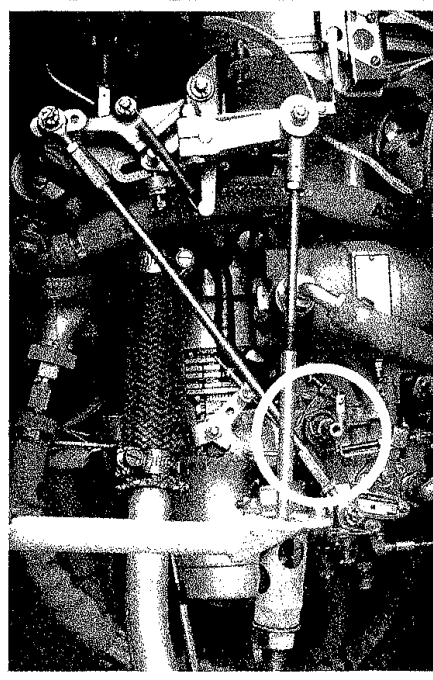
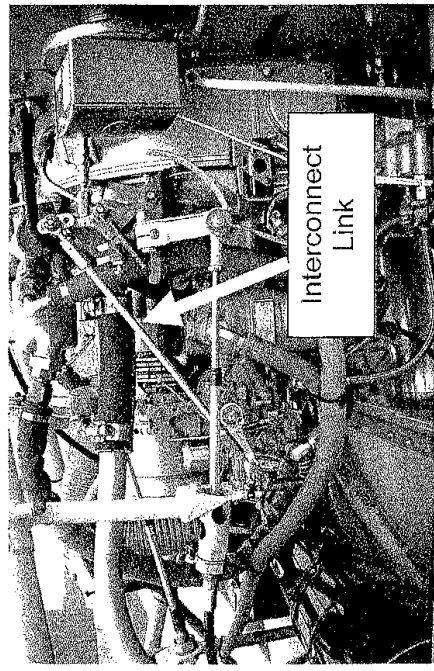


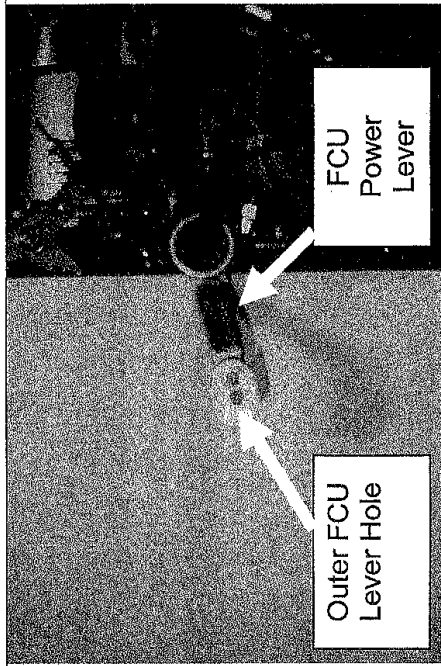
**Operation 1400
Rig FCU Linkage**

(g) Make the following adjustments as required if clearances in sequence (c) or (f) are not met:

Adjust FCU power lever setting angle by means of the serrated spacer to obtain the desired gap between the interconnect link and the FCU lever clamp nut extension. (Rotate washer CW to increase gap).

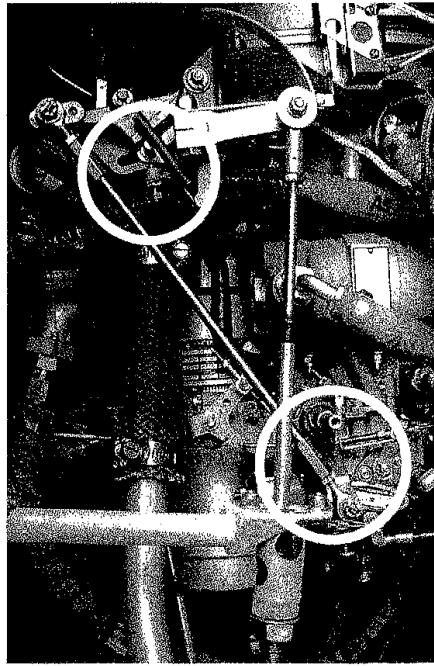
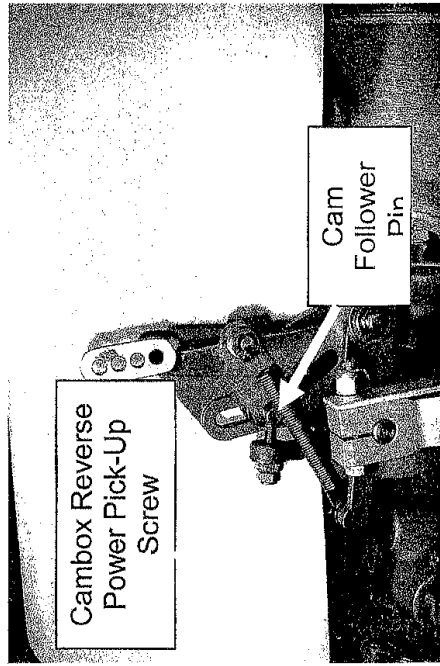
Adjust the length of the interconnect link to obtain the desired gap between the cam follower pin and the intermediate lever.

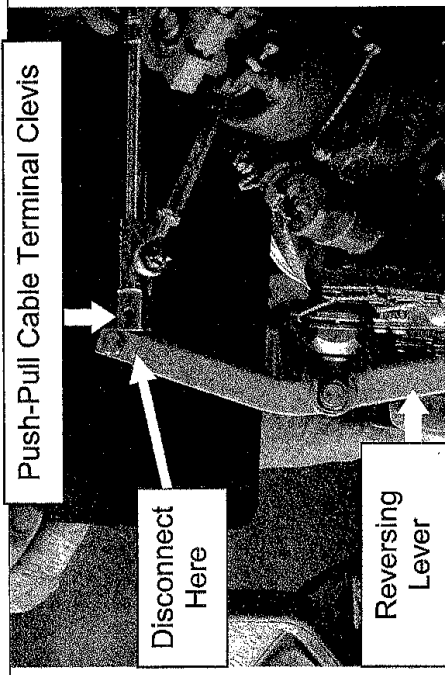




**Operation 1400
Rig FCU Linkage**

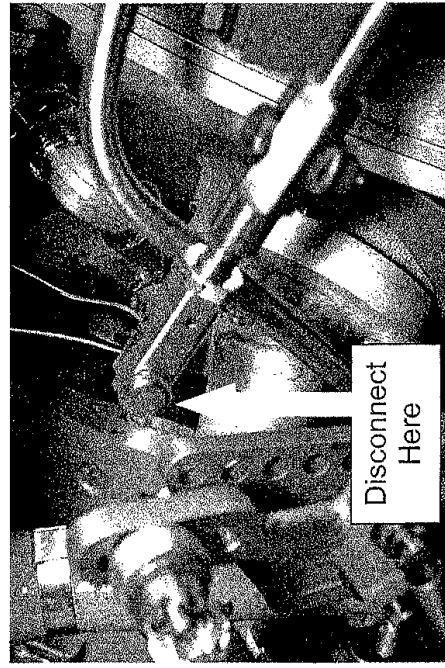
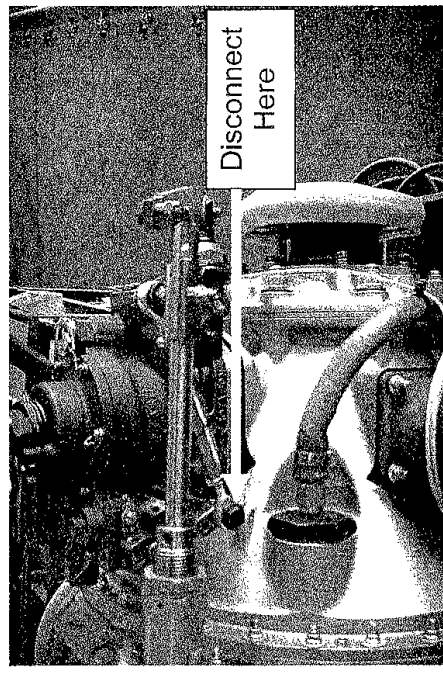
- (h) Connect the rear interconnect link rod end to the outer FCU lever hole and tighten to the correct torque.
- (i) Set Dead Band by adjusting cambox reverse power pick-up screw to give 1/8-inch gap between the cam follower pin and reverse power pick-up screw. (Ensure head of screw is on back of the lever).

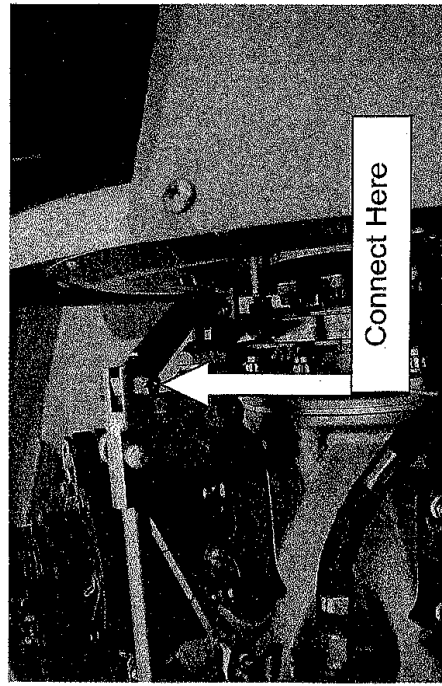
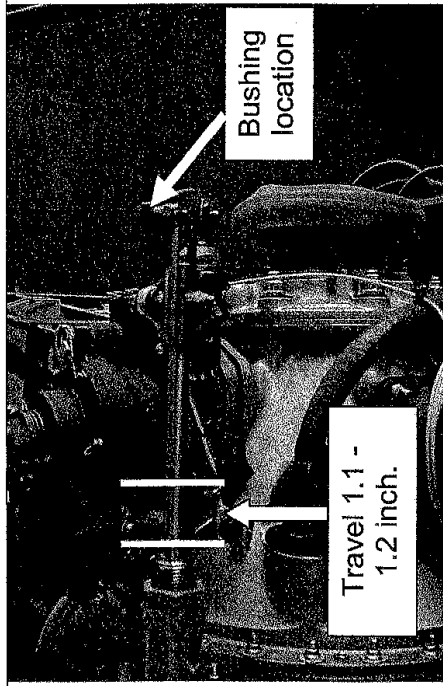




**Operation 1500
Rig Beta Cable and Front Propeller Control Linkage**

(a) Disconnect the front push-pull cable terminal clevis from the reversing lever, disconnect the interconnect link from the propeller governor reset lever and disconnect the rear push-pull cable clevis from the beta cam.





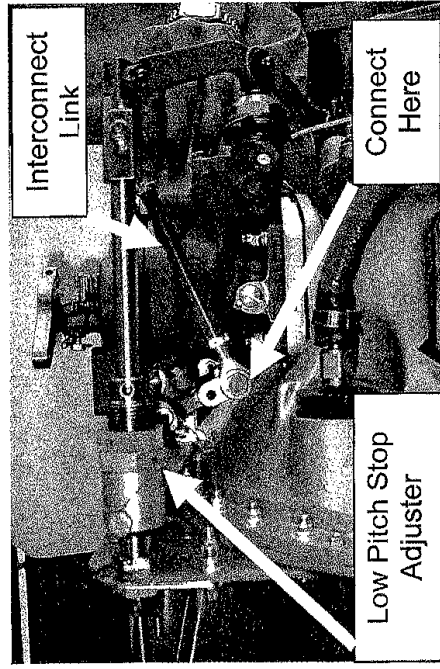
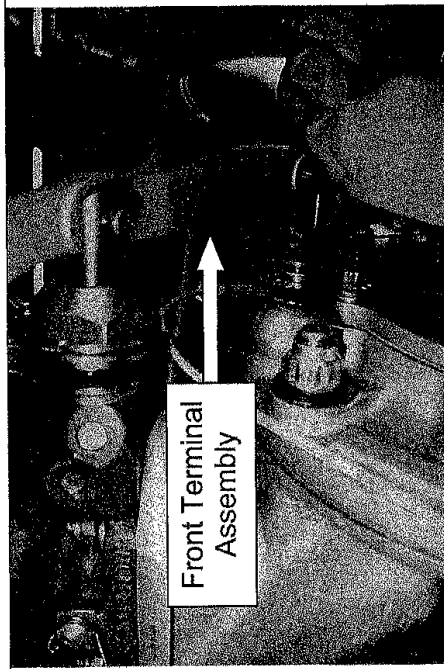
Operation 1500

Rig Beta Cable and Front Propeller Control Linkage

(b) Verify that available push-pull cable travel is 1.1 - 1.2 inch (28 - 30.5 mm). Adjust cable as required (Ref. Engine Maintenance Manual 76-10-00). Confirm correct cable engagement in terminals.

(c) Connect front terminal clevis to reversing lever.

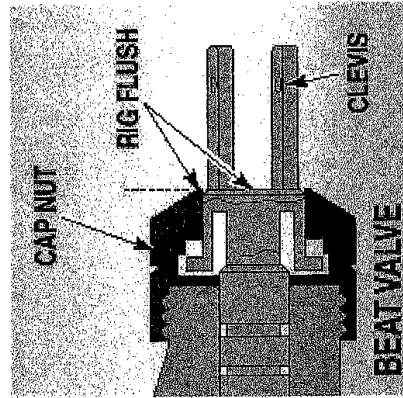
Caution: Do not forget to reinstall bushing



Operation 1500

Rig Beta Cable and Front Propeller Control Linkage

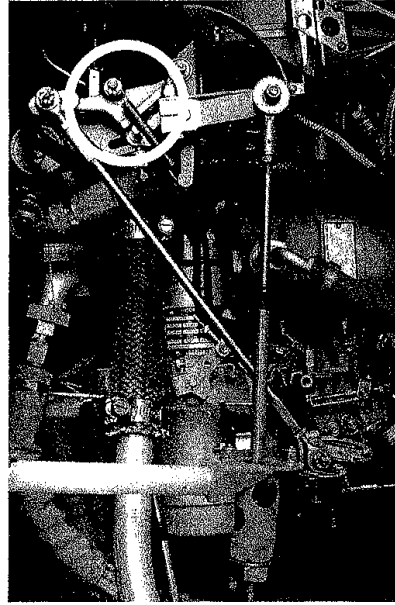
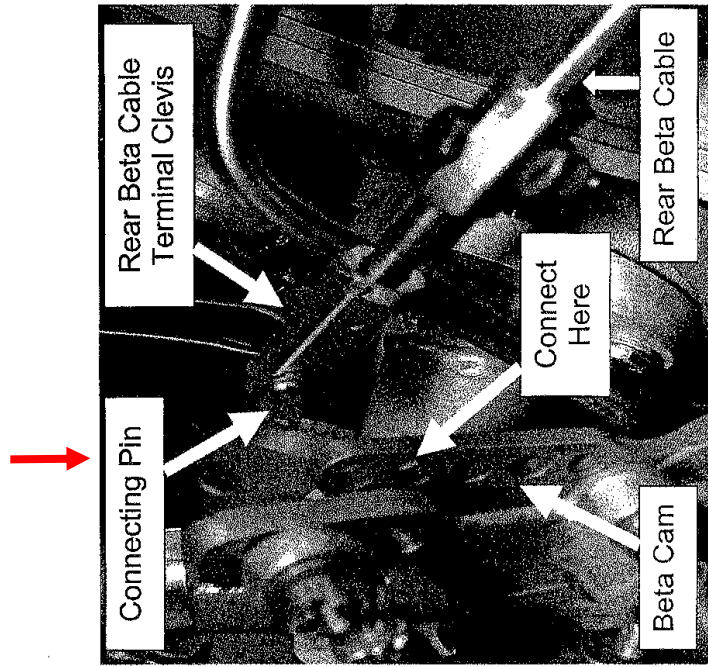
- (d) With forward pressure on front terminal assembly, adjust the low pitch stop adjuster so that the bottom of the beta valve clevis slot is even with the end of the end of the cap nut. Tighten the low pitch stop adjuster to the required torque.
- (e) With loading on front terminal assembly as in (d) adjust the interconnect link to align with the outer hole of the reset lever. Shorten the link by one turn and connect.

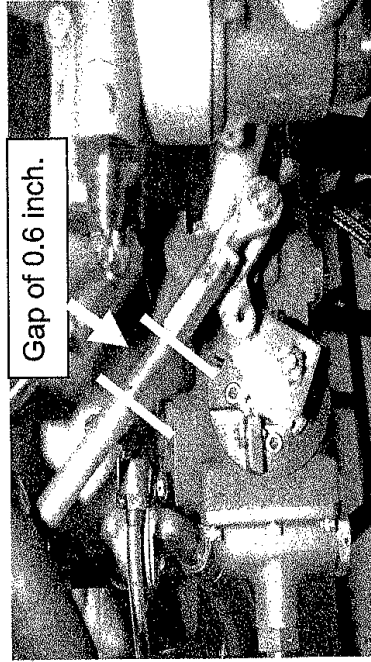
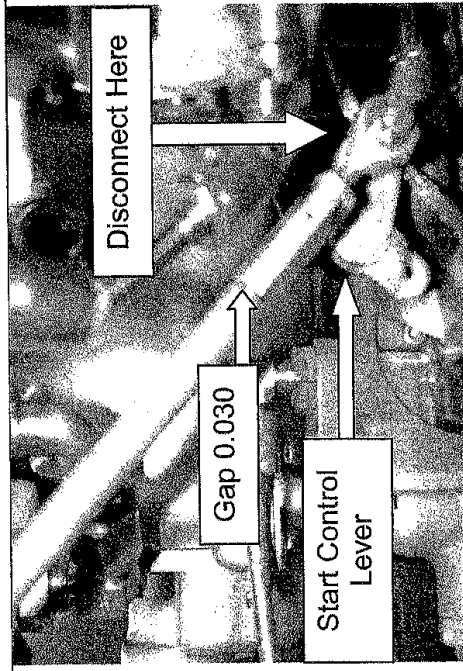


Operation 1500

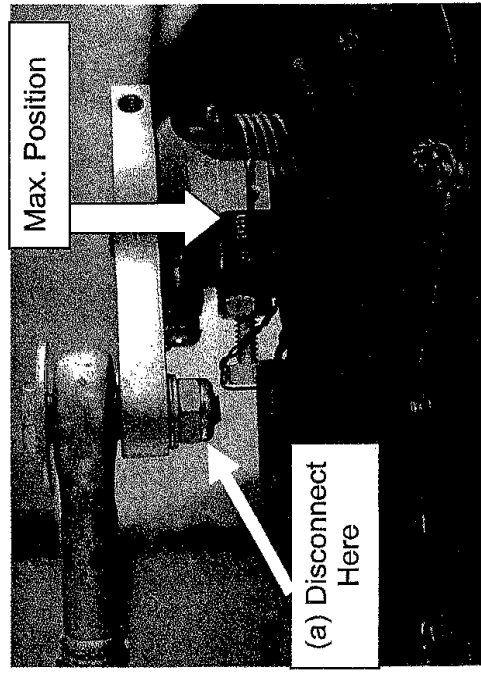
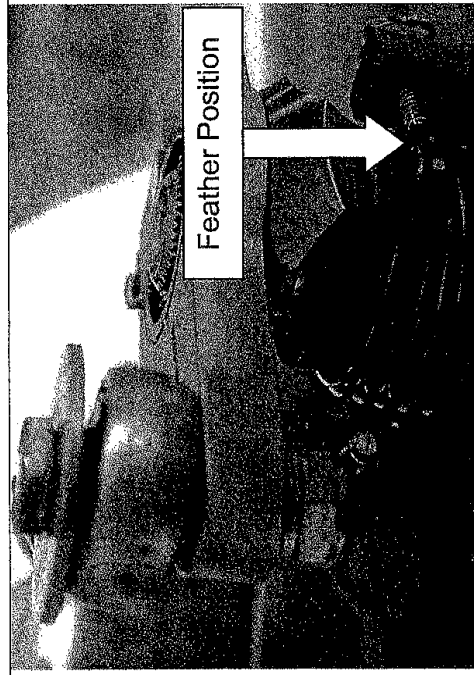
Rig Beta Cable and Front Propeller Control Linkage

- (f) Position the cockpit power lever in the mid forward range.
- (g) With forward pressure on the rear beta cable terminal and aft pressure on the beta cam, adjust the rear beta cable terminal clevis to align with the second lowest cam hole so that the connecting pin can be installed with light force.
- (h) Cycle the cockpit power lever in the forward operating range and confirm smooth motion without noticeable friction at the beta cam.
- (i) Secure the rear beta cable clevis with a washer and cotter pin.





- Operation 2000**
Condition Control System Rigging Procedure (if applicable)
- (a) Disconnect the linkage terminal from the start control input lever.
 - (b) Move the cockpit condition lever through the full range and verify that the motion is free of binding and excessive friction.
 - (c) Move the cockpit condition lever through the full range and verify that the linkage has sufficient travel to move the start control lever from the cut-off position to the 90° full travel position.
 - (d) Place the cockpit condition lever in the CUTOFF position.
-
- (e) Adjust the length of the terminal link so that the start control lever makes firm contact with the cutoff stop.
 - (f) Set the cockpit condition lever in the GROUND IDLE position.
 - (g) Verify that the start control lever has moved to the 45° detent position. (Ref. Maintenance Manual 76-10-00).
 - (h) Install the interconnect link between the FCU power lever and the start control lever.
 - (i) With the control lever in the GROUND IDLE position and the FCU power lever at the pick-up position, check that a gap of 0.6 inch. (15 mm) exists in the telescopic link. Adjust terminal length as required.



Operation 3000

Propeller Control System Rigging Procedure

- (a) Disconnect the propeller control push-pull cable terminal from the propeller governor speed select lever.
- (b) Move the cockpit propeller control lever through its full range and confirm that the motion is free of binding and excessive friction.
- (c) Move the cockpit propeller control lever through its full range and confirm that the motion is sufficient to move the propeller governor speed select lever through its entire range.

(d) Set the cockpit propeller control lever in the FEATHER position.

(e) Set the propeller governor speed select lever to the feather stop, align the control cable rod end with the hole in the propeller governor speed select lever and connect.

(f) Move the cockpit propeller control lever to the MAX RPM position and back to FEATHER. Confirm that the propeller governor contacts the maximum speed and feather stops with a minimum of 1/16 inch cushion at the cockpit propeller control lever.

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